"The concerns we have are that the cables and fluid lines may not be long enough to reach between elements, and/or they may not be lined up correctly," said Mike Haddad, NASA structural and mechanism engineer. "Test aids help ensure that the fit will be precise."

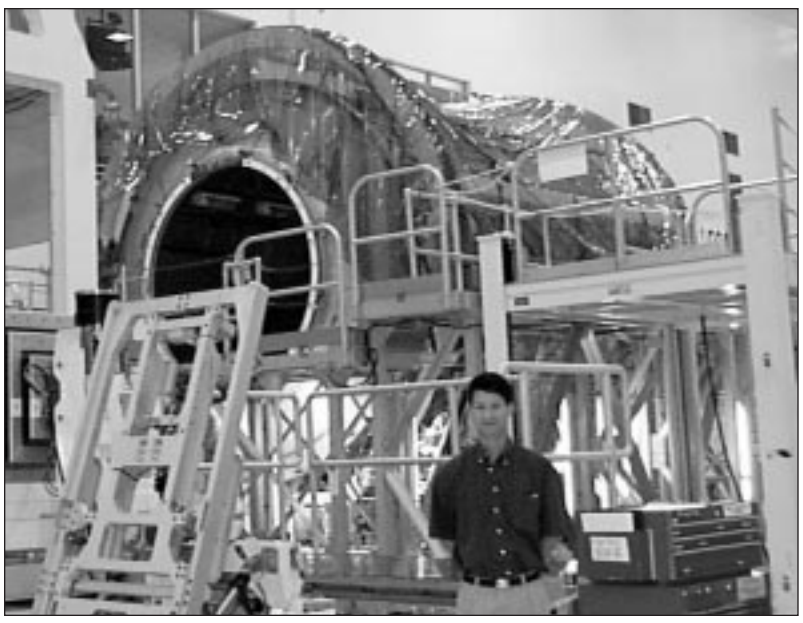
The shuttle can carry station elements three ways. Large elements (such as the truss structures) are placed directly into the payload bay. Other elements that need a 1g atmosphere environment may be shipped up to the station in the MPLMs. Smaller items, such as the Pressurized Mating Adapters, are placed on a Spacelab pallet.

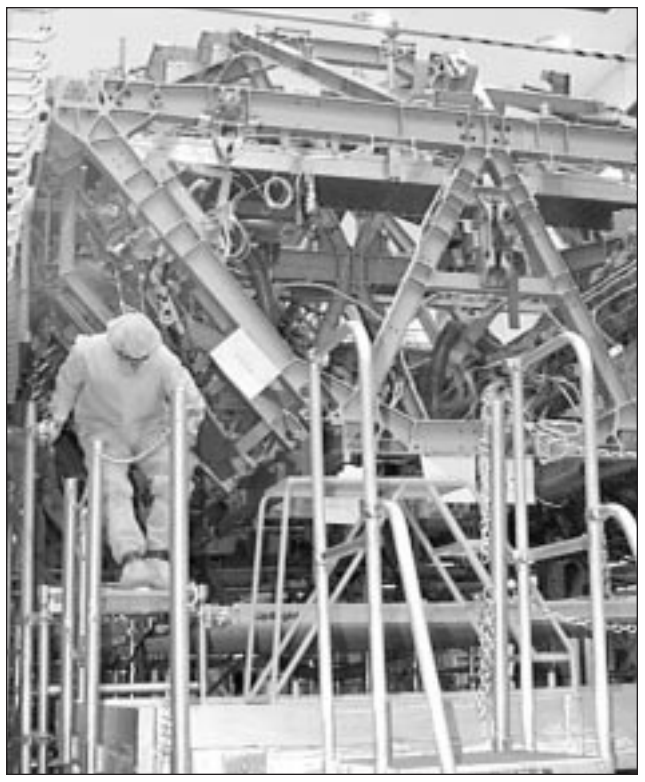
Destiny, the U.S. laboratory module, is in the SSPF. It has undergone tests since it arrived at KSC November 16, 1998.

Some equipment has been updated and some wiring and insulation work on fluid lines on the inside has been completed. Remaining tasks include outfitting Destiny with Kevlar debris shields, and aluminum primary debris panels atop them.

Not only space station elements, but many years of planning and hard work are coming together at KSC.

"I've been working on this program for three years," said Bill Dowdell, NASA manager of the 3A and 4A Space Station Hardware Integration Office at KSC. "Getting this hardware built and transported to KSC has been a monumental task." ■





The Mobile Transporter (top left) sits protectively wrapped, primed and ready for its turn through processing. The MT, a high strength, stiff aluminum structure that can handle loads up to 46,000 lbs., will be attached to the truss (above) providing mobility to relocate the MSS to other station worksites.

Glenn Chinn, (left) NASA lead engineer, Multi-Purpose Logistics Modules and Nodes 2 and 3, stands in front of one of the Italian-built MPLMs.

NASA JSC Photos by Nicole Cloutier

New Canadian arm to flex muscles on space station

A new double-ended Canadian robotic arm will play a big role in International Space Station (ISS) assembly and maintenance. The arm can ride along the station truss or it can "walk" around the ISS, securing first one end and then the other as it moves.

Called the Space Station Remote Manipulator System (SSRMS), the arm is part of the Mobile Servicing System (MSS) that Canada will contribute to the ISS.

Unlike the shuttle's Canadarm, which is owned by NASA, Canada will retain ownership of the MSS including the SSRMS.

Stephen Mozes, manager, Canadian Space Agency Liaison Office at Kennedy Space Center, said the Canadarm was originally designed in 1973 by Spar Aerospace Ltd. It was sponsored by the National Research Council of Canada. NASA ordered five arms for about $600 million.

The Canadarm has flown more than 50 shuttle missions and has been successful every time. Lessons learned from it were applied to the new ISS arm.

The total Canadian station contribution comes in four basic parcels: the SSRMS, the Mobile Remote Servicer Base System (MBS), the Special Purpose Dexterous Manipulator (SPDM) and the Artificial Vision Unit.

The arm has seven degrees of freedom. It is a re-locatable system of the MSS that normally will operate from a Power Data Grapple Fixture (PDGF) located on the MBS. It also has the capability to be located on a PDGF positioned on the ISS. During typical operations, the arm will be mounted on the MBS.

There are two ways for the arm to move on board the station. It can ride along the truss or it can walk via 10 grapple fixtures placed strategically across the ISS. "If you can imagine, the grapple fixtures are like the wall outlets in your house only they are elegant data, power and video lines running through one portion of the space station to other designated points," says Mozes.

The arm, folded and wrapped up, is in the Space Station Processing Facility at the Kennedy Space Center. Since it cannot hold its weight in 1 g, it is counterbalanced by weights. In orbit, it can move about 100,000 kilograms – about the weight of a loaded Orbiter. "You get all of this operating on the power that it takes to turn on seven light bulbs," Mozes said.

The MBS will be mounted on the Mobile Transporter. The Mobile Transporter will provide the physical and electrical interface between the MBS and the space station truss for translational mobility of the MSS.

The SPDM is a small, two-armed robot capable of handling the delicate assembly tasks currently handled by astronauts during space walks. It provides an on-orbit maintenance and servicing capability, including manipulating, installing, and removing small payloads such as batteries, power supplies and computers as well as operating ISS robotic tools including specialized wrenches and socket extensions to be used for delicate maintenance and servicing tasks; manipulating, installing, removing and inspecting scientific payloads; and providing lighting and closed-circuit TV monitoring for work areas.

The arm will be delivered to the station on Flight 6A (STS-100). It will be launched folded, hinged in the middle of each boom so it can fit across the shuttle's payload bay. Canadian Astronaut Chris Hadfield and Astronaut Scott Parazynski will do a space walk to deploy the arm. Hadfield will be the first Canadian space walker.

The new double-ended Canadian robotic arm is shown folded and wrapped up in the Space Station Processing Facility at the Kennedy Space Center. In orbit, it can move about 100,000 kilograms – about the weight of a loaded Orbiter operating on the power that it takes to turn on seven light bulbs.

Built at a cost of about $1 billion (U.S. dollars), the MSS has already generated some $4 billion (U.S. dollars) in spin-off benefits, having found applications in medicine and the nuclear power industry.

"There will come a time when the space station cannot be built without the Mobile Servicing System," said Mozes. "Until that point is reached, the shuttle arm is being used as well as space walks. So it is a great privilege to be able to contribute this necessary element to the ISS Program."

The SSRMS is scheduled for launch no earlier than July 2000. The MBS is set to fly no earlier than May 2001, while the SPDM is scheduled for no earlier than summer 2003. A revised assembly sequence is under development and review with all ISS partners. ■